



## Climate change and tick-borne diseases: A research field in need of long-term empirical field studies

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### Abstract:

The emerging research field focusing on climate-driven change in spatial and temporal patterns of arthropod vectors, vector-borne pathogens, or incidence of vector-borne diseases is characterized by a plethora of models based on empirical data of variable quality and a disturbing lack of empirical long-term studies that will allow us to demonstrate that future change was in fact driven by climate factors. Problems and possibilities related to research on climate change and tick-borne diseases are addressed, using examples from the author's studies on the common tick, *Ixodes ricinus*, in Sweden and the Rocky Mountain wood tick, *Dermacentor andersoni*, in Colorado, USA. The data from Sweden provided tantalizing hints that climate warming allowed *I. ricinus* to expand its distribution toward the north and become more abundant in Central Sweden from the early 1980s to the early 1990s. However, a lack of comprehensive field data on spatial patterns of tick distribution or abundance in Central Sweden during the early 1980s precluded a clear demonstration that changes in tick distribution or abundance patterns had taken place. The Colorado Front Range area, which includes the transitional zone between the Central Plains and the Rocky Mountains, provides a wealth of dramatic elevation and climate gradients. Studies during 2005-2006 in Poudre Canyon of Larimer County, Colorado, demonstrated that local elevation gradients include the entire climatic range where *D. andersoni* can establish stable populations; the human-biting adult tick stage is commonly encountered at elevations between 2100 and 2500 m but very rarely at lower elevations to the east or higher elevations to the west. Further, it was found that temperature-related factors (e.g., maximum temperature, growing degree days) could explain peak abundance of host-seeking *D. andersoni* adults per drag sampling time unit (hereinafter referred to as abundance) within a uniform habitat type (south/west-facing, rocky hillsides with mixed grasses, brush, and scattered pine-juniper-aspen) along the Poudre Canyon elevation gradient. In Poudre Canyon, peak abundances of host-seeking *D. andersoni* adults occur at mid-range elevations (2200-2350 m), with suitable tick habitat available both in warmer areas at lower elevations in the canyon (1600-2200 m) and in cooler areas at higher elevations at the top of the canyon (2350-2500 m). A future change in the local climate therefore has the potential to cause a readily detectable shift in the spatial pattern of abundance of *D. andersoni* along this elevation gradient. This is the type of situation where empirical long-term field studies will allow us to demonstrate that future climate change did result in changes in the spatial patterns of tick distribution, tick abundance, pathogen presence, or pathogen infection rates.

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### Resource Description

**Exposure :** ☐

# Climate Change and Human Health Literature Portal



weather or climate related pathway by which climate change affects health

Ecosystem Changes, Temperature

**Temperature:** Fluctuations

**Geographic Feature:**

resource focuses on specific type of geography

Mountain

**Geographic Location:**

resource focuses on specific location

Non-United States, United States

**Non-United States:** Europe

**European Region/Country:** European Country

**Other European Country :** Sweden

**Health Impact:**

specification of health effect or disease related to climate change exposure

Infectious Disease

**Infectious Disease:** Vectorborne Disease

**Vectorborne Disease:** General Vectorborne, Tick-borne Disease

**Tick-borne Disease:** General Tick-borne Disease

**Mitigation/Adaptation:**

mitigation or adaptation strategy is a focus of resource

Adaptation

**Model/Methodology:**

type of model used or methodology development is a focus of resource

Exposure Change Prediction

**Resource Type:**

format or standard characteristic of resource

Review

**Timescale:**

time period studied

Short-Term (

**Vulnerability/Impact Assessment:**



resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content